



Growing
ideas
through
networks

UAS and their application in forest monitoring

Géza Király, Rolf Farkas, Károly Szabó, Botond Szász

University of Sopron, Faculty of Forestry, Institute of Geomatics and Civil Engineering



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Forest monitoring

- Quality

- Forest health

- Quantity

- Area, Height, Volume

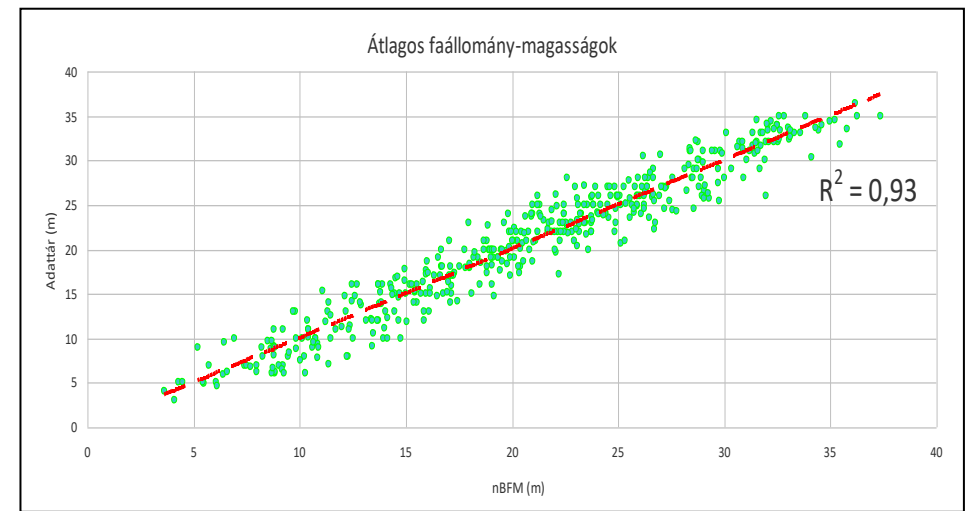
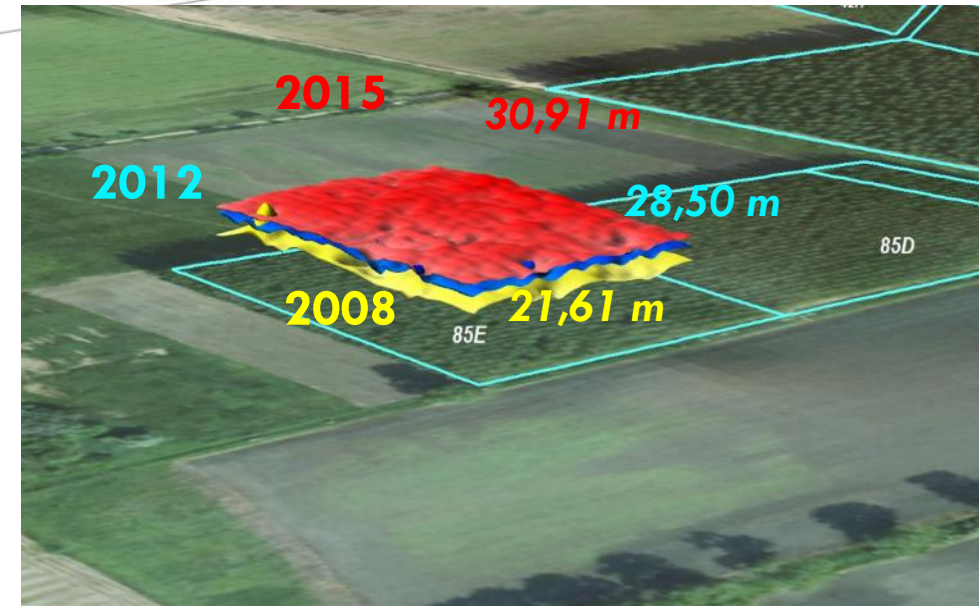
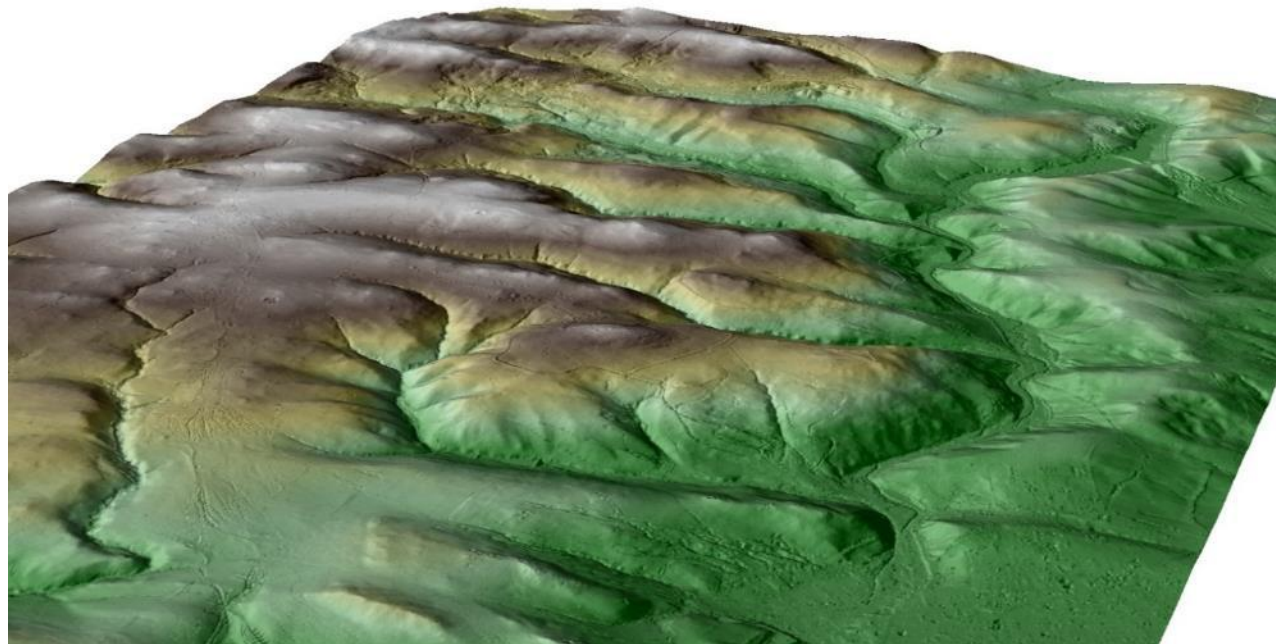
- Image matching

- Semi-global matching (SGM) (Hirschmüller, 2005 and 2008)
- Structure from Motion (SfM) (Snavely, N., 2008)

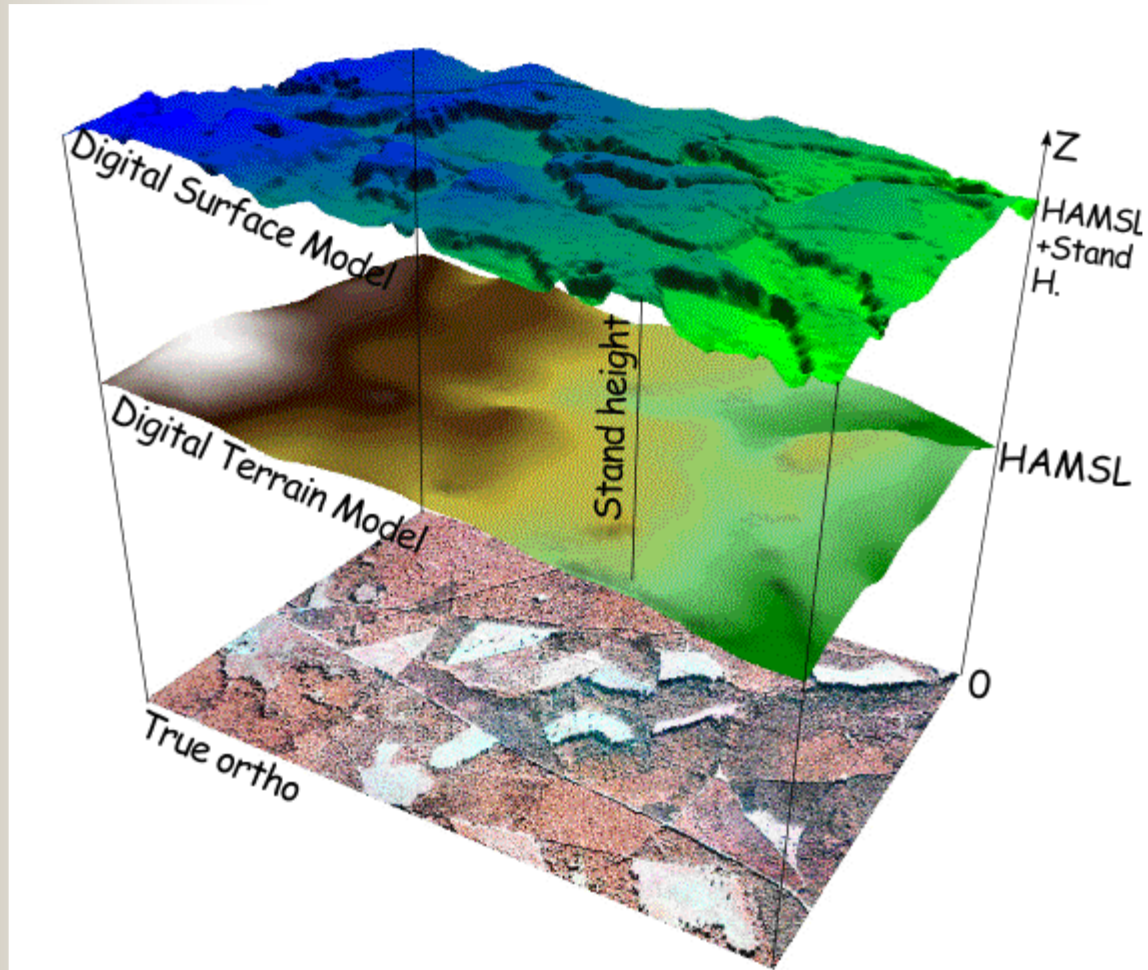
- Tree detection

- Inverse watershed
- Geomorphon
- Local maxima

Forest stand height



normalised Digital Surface Model, Canopy Height Model (nDSM – CHM)



$$\text{nDSM} = \text{DSM} - \text{DTM}$$

$$V = F_c \cdot G_c \cdot H$$

where:

V: Volume (m^3)

F_c : Form factor of the Crown projection

G_c : Sum of Crown projection (m^2)

H: Average Stand Height (m)

DJI MATRICE600Pro



- Hexacopter
 - ~2 kg payload
 - ~30 min flying time
 - Redundancy (GPS, INS, battery)
- Sony A7R camera
 - 36 MP
 - Full Frame
 - 35 mm-es optics
- Sequoia multispectral camera
 - 1,2 MP
 - 4 bands
 - 3,98 mm (30 mm)



DJI MATRICE600Pro



Sony A7R camera
Parrot Sequoia

DJI MATRICE 600Pro

Sony A7R kamera
Parrot Sequoia



Parrot Sequoia





Soproni Egyetem Botanikus Kert

- 2018.06.10
- ~180 m-es flying height
- 124 photos
- ~2,5 cm ground resolution
- Products
 - Ortophoto-mosaic
 - Digital Surface Model

Survey Data

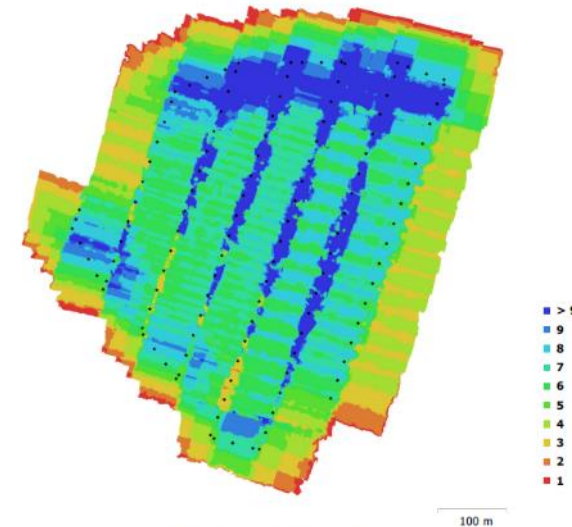


Fig. 1. Camera locations and image overlap.

Number of images:	124	Camera stations:	124
Flying altitude:	171 m	Tie points:	154,243
Ground resolution:	2.19 cm/pix	Projections:	379,361
Coverage area:	0.328 km ²	Reprojection error:	0.504 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
ILCE-7R (35 mm)	7360 x 4912	35 mm	4.89 x 4.89 μ m	No

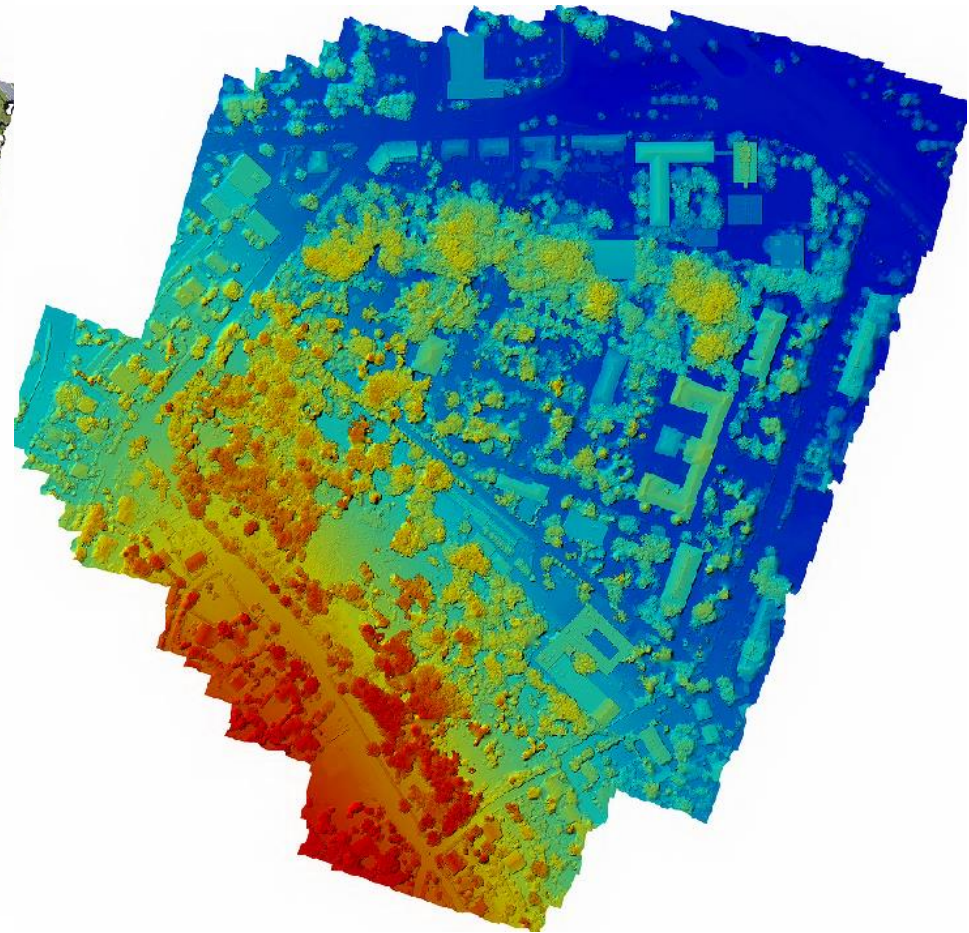
Table 1. Cameras.

Soproni Egyetem Botanikus Kert

Ortophoto



DSM

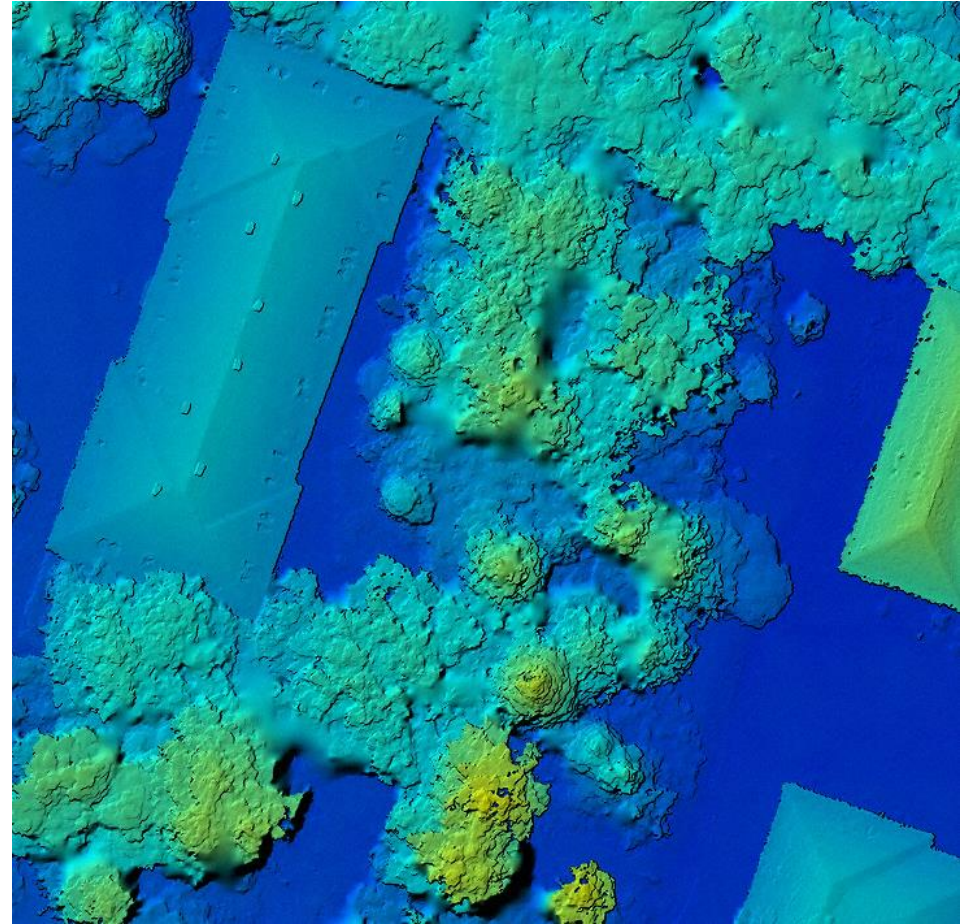


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Ortophoto



DSM

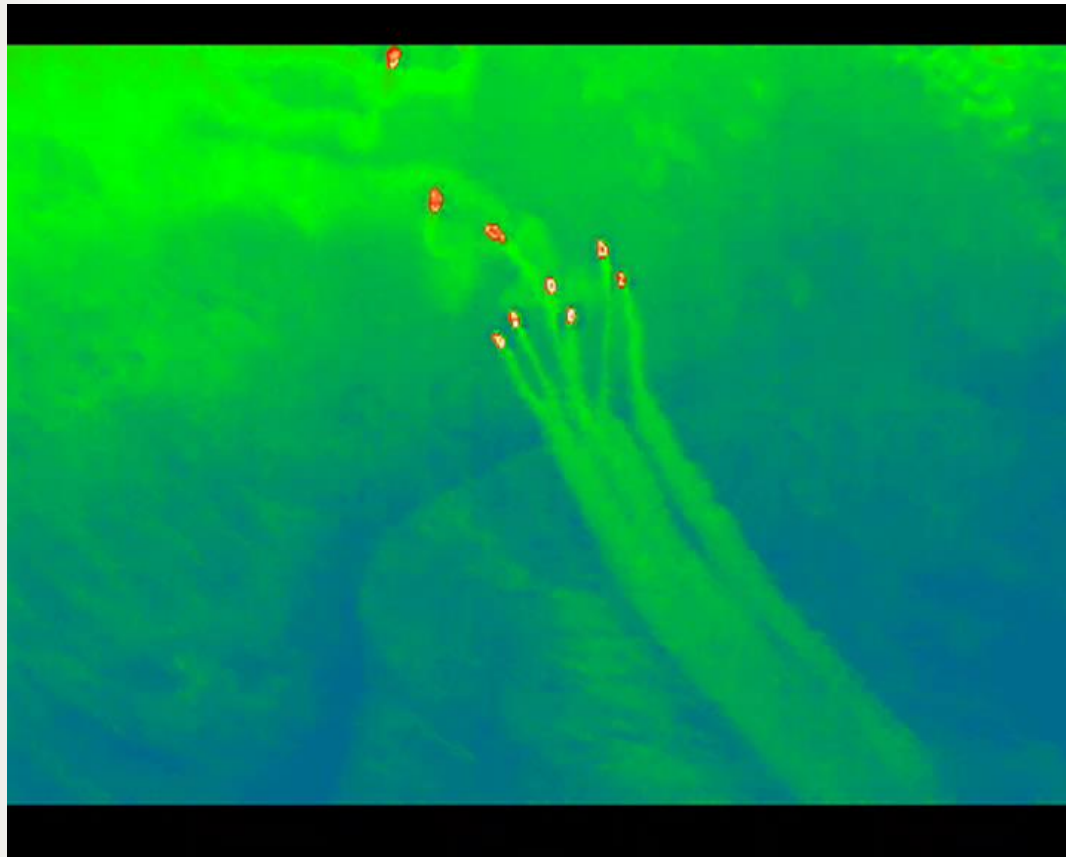


DJI Matrice 100

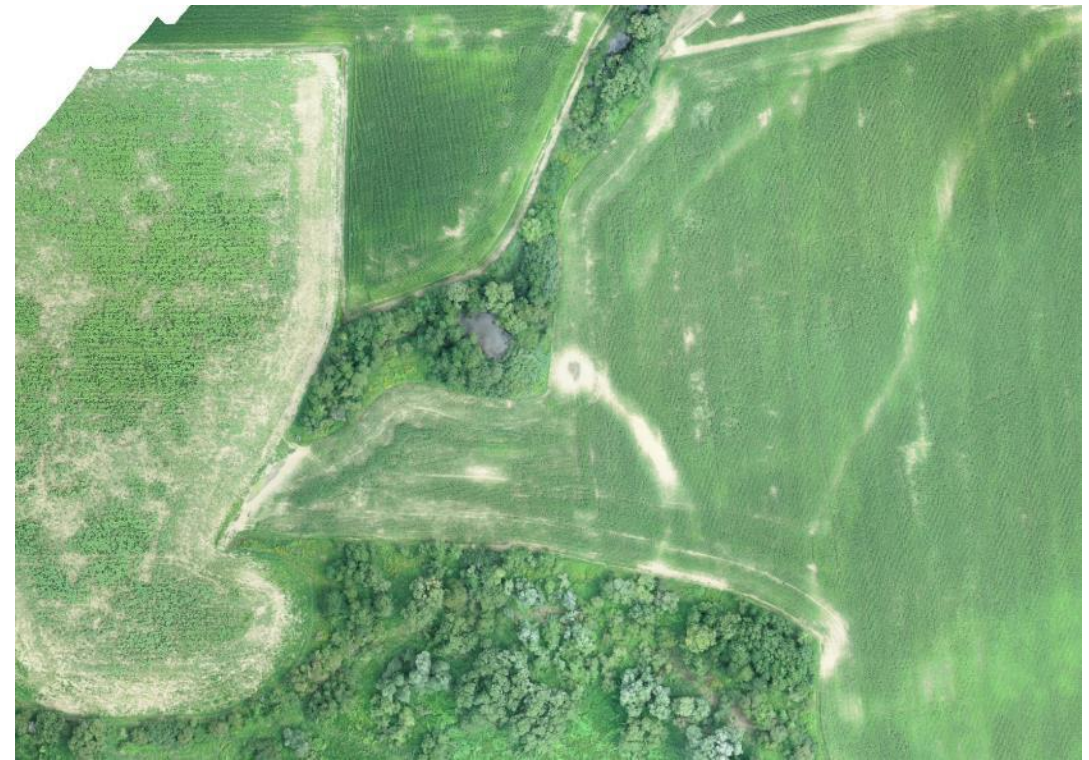


- Quadcopter
- ~20 min. flying time
- X3 camera
 - 12 MP,
 - 3,61 mm (20 mm)
- XT thermal camera,
 - 336*256,
 - 19 mm (~114 mm)

Damages caused by games



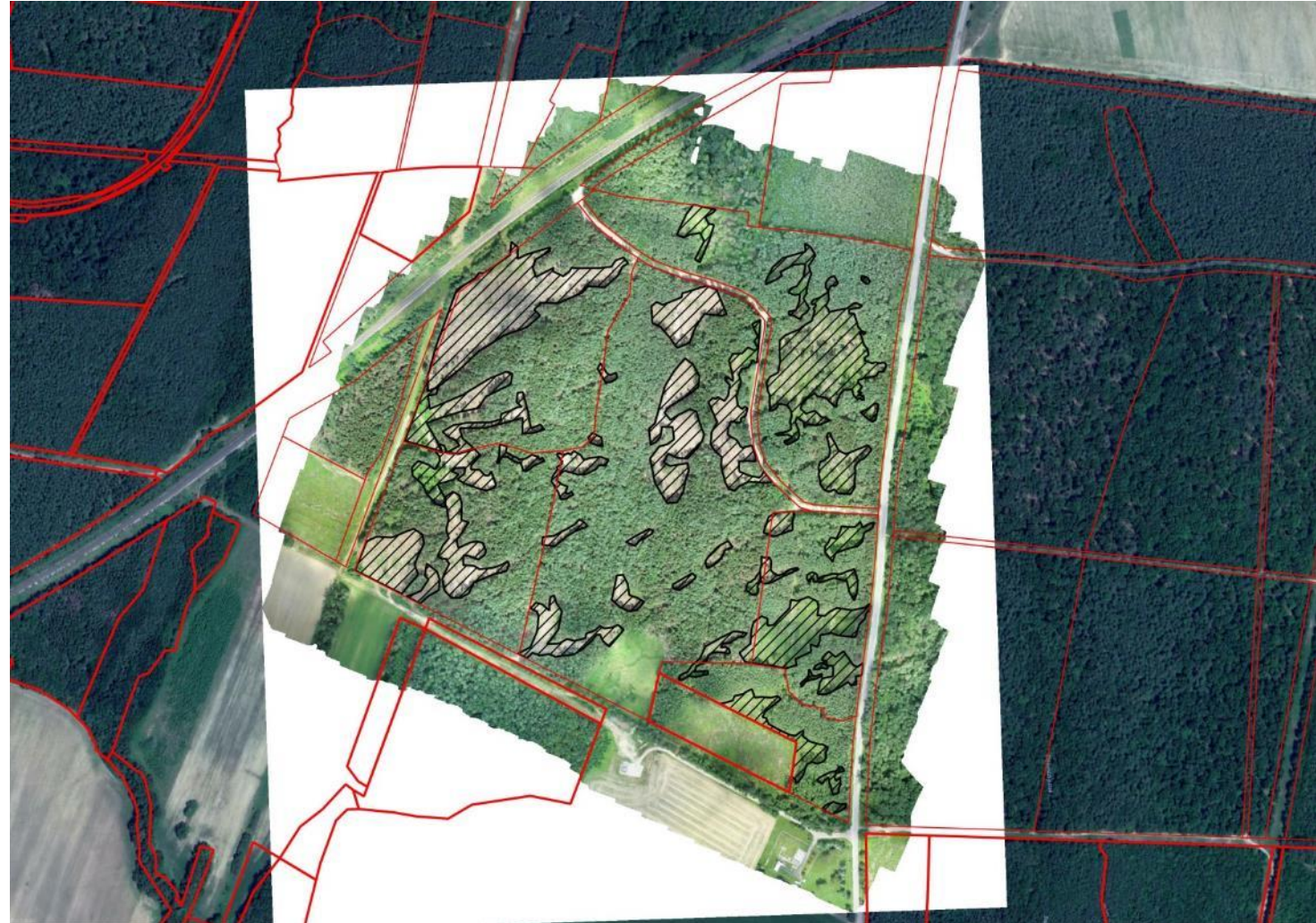
Thermal camera



RGB camera

Health issues of the Norway spruce (*Picea abies*)

- More and more health problem of Norway spruce
- Planning the felling
- Determination of the area

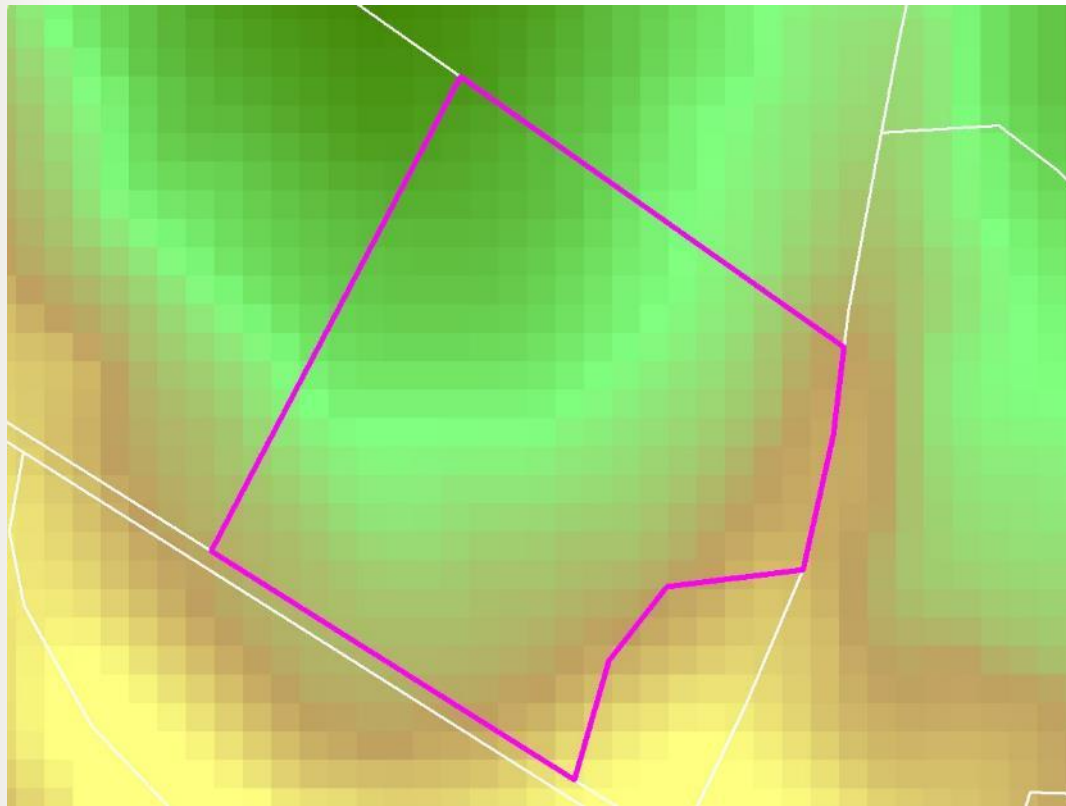


Health issues of the Scots pine (*Pinus sylvestris*)

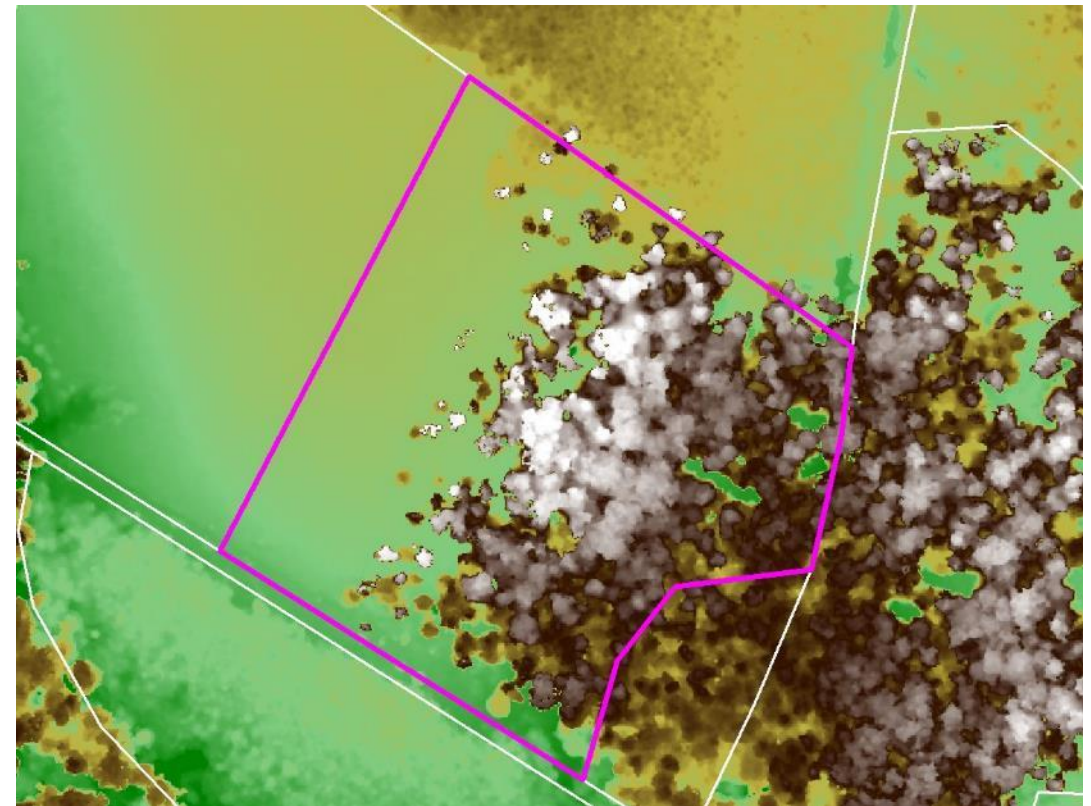
- Detected on Sentinel-2
- Surveyed by UAS
- Field sampled



Hegyhátszentmárton 5 E1 (126 years old Beech - Scots pine)

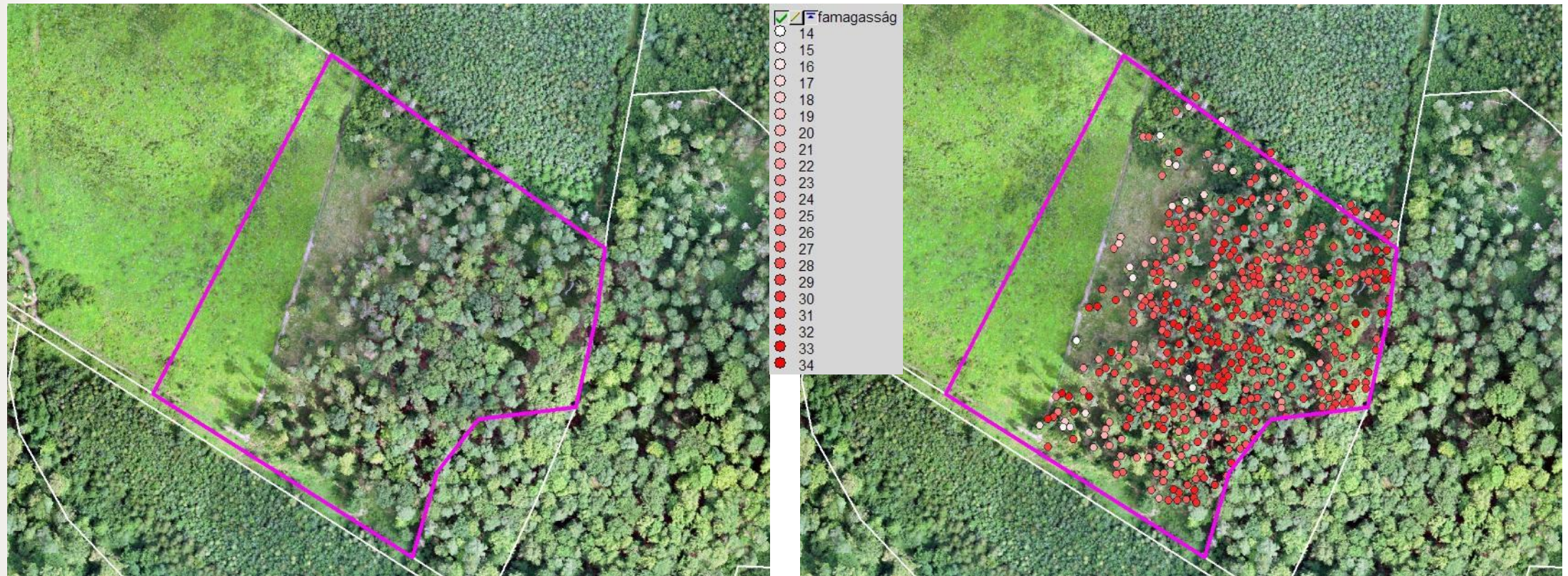


DTM



DSM

Hegyhátszentmárton 5 E1 (126 years old Beech - Scots pine)



Ortho

Ortho + Tree Tops

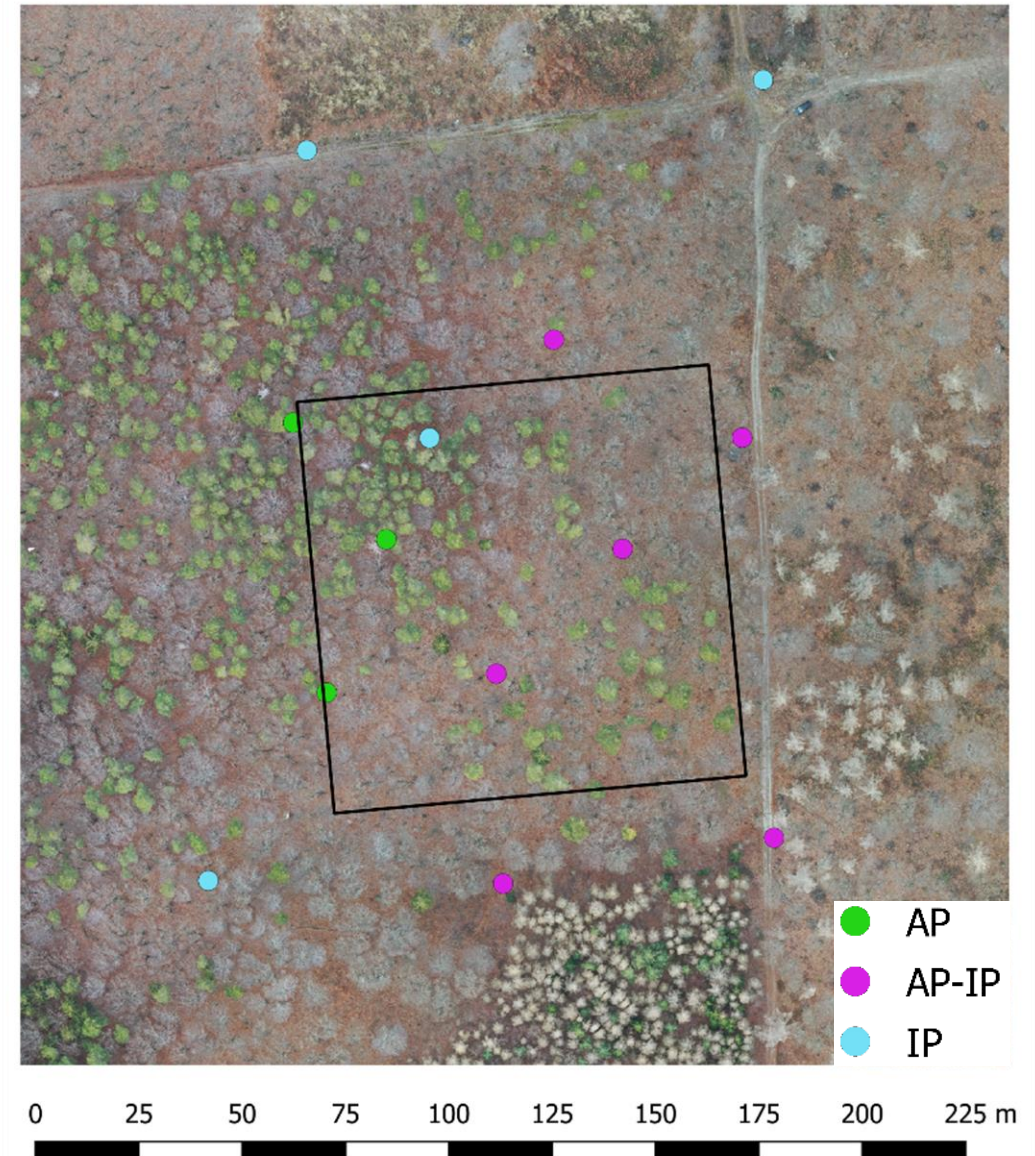
Deriving the DTM

Material and methods

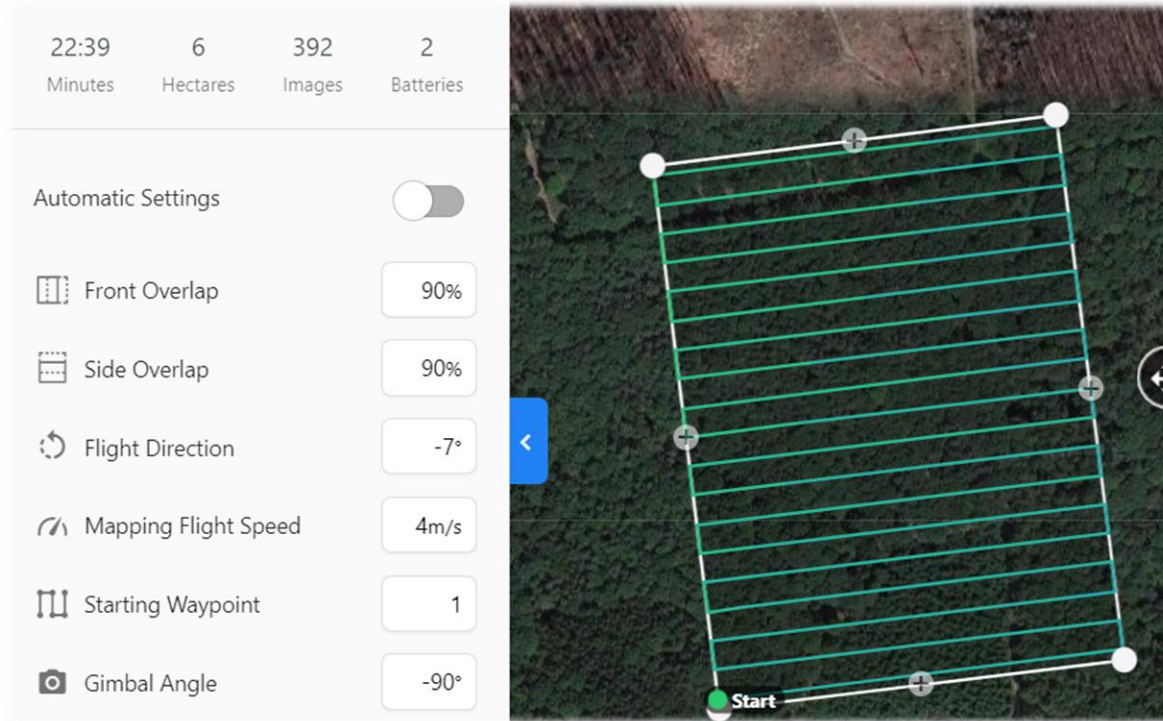
- Sample area: 100 m x 100 m
- TLS locations: 9
- Number of GCPs: 10



DJI Mavic 2 Pro (forrás: internet)



Material and methods



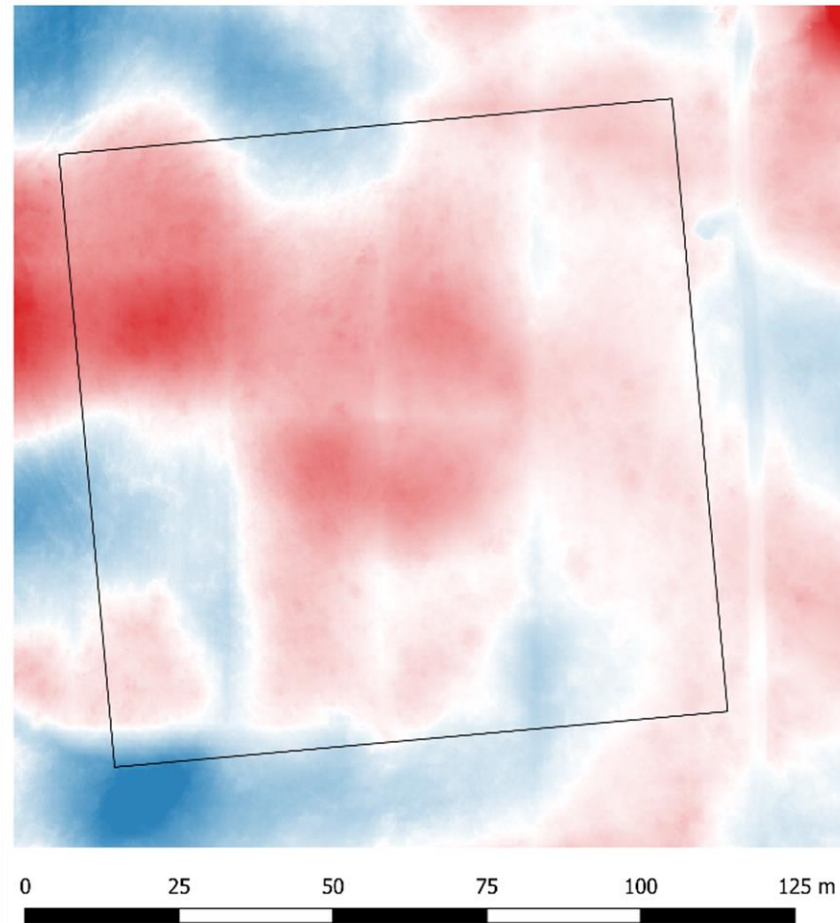
Flight planning in DroneDeploy

Terrain Awareness



Material and methods

- Flight
 - Taking images
 - 3 different flying height
 - 3 x 3 different overlap
 - 27 total variations
- Processing
 - Agisoft Metashape
 - CloudCompare
 - LASTools
 - Scripts
 - QGIS

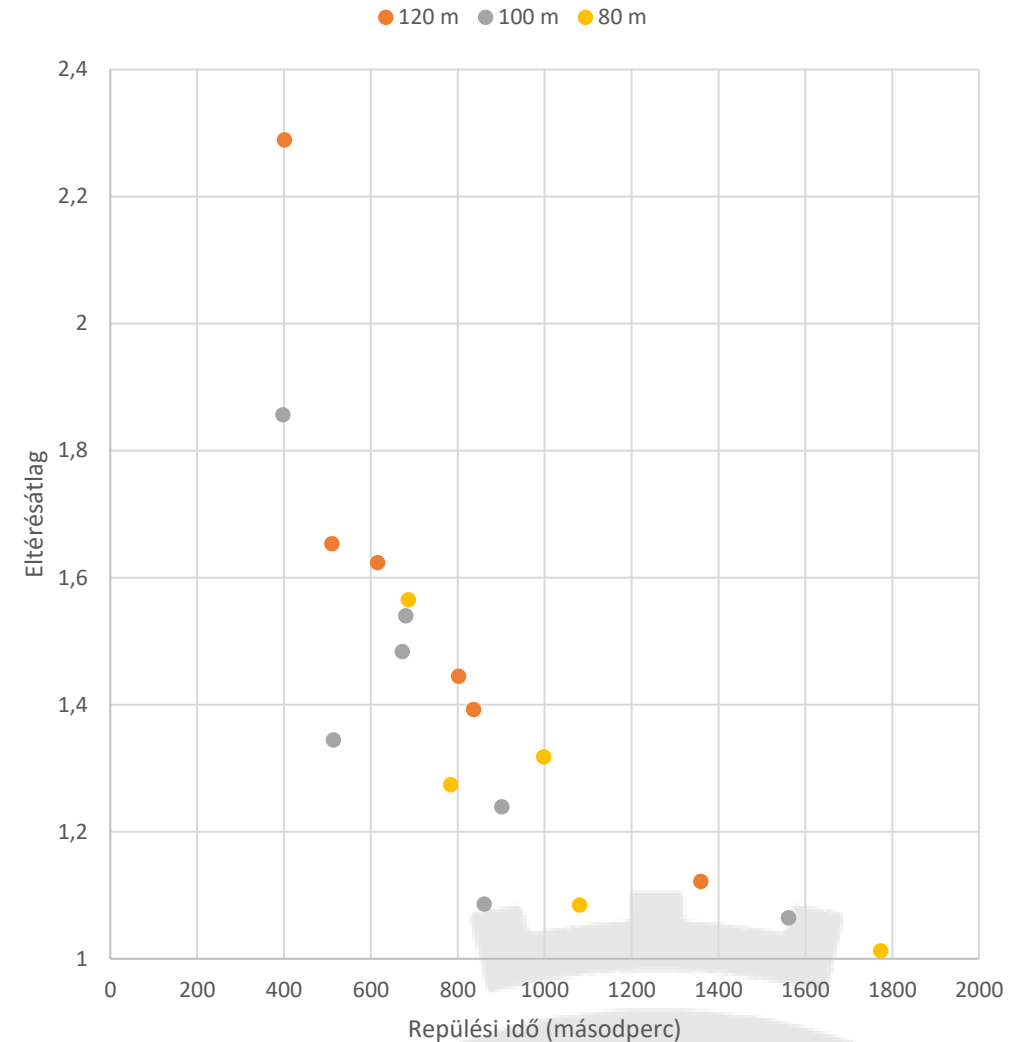


- Investigated parameters
 - Point density
 - Size of the triangles in TIN
 - Deviations from the reference

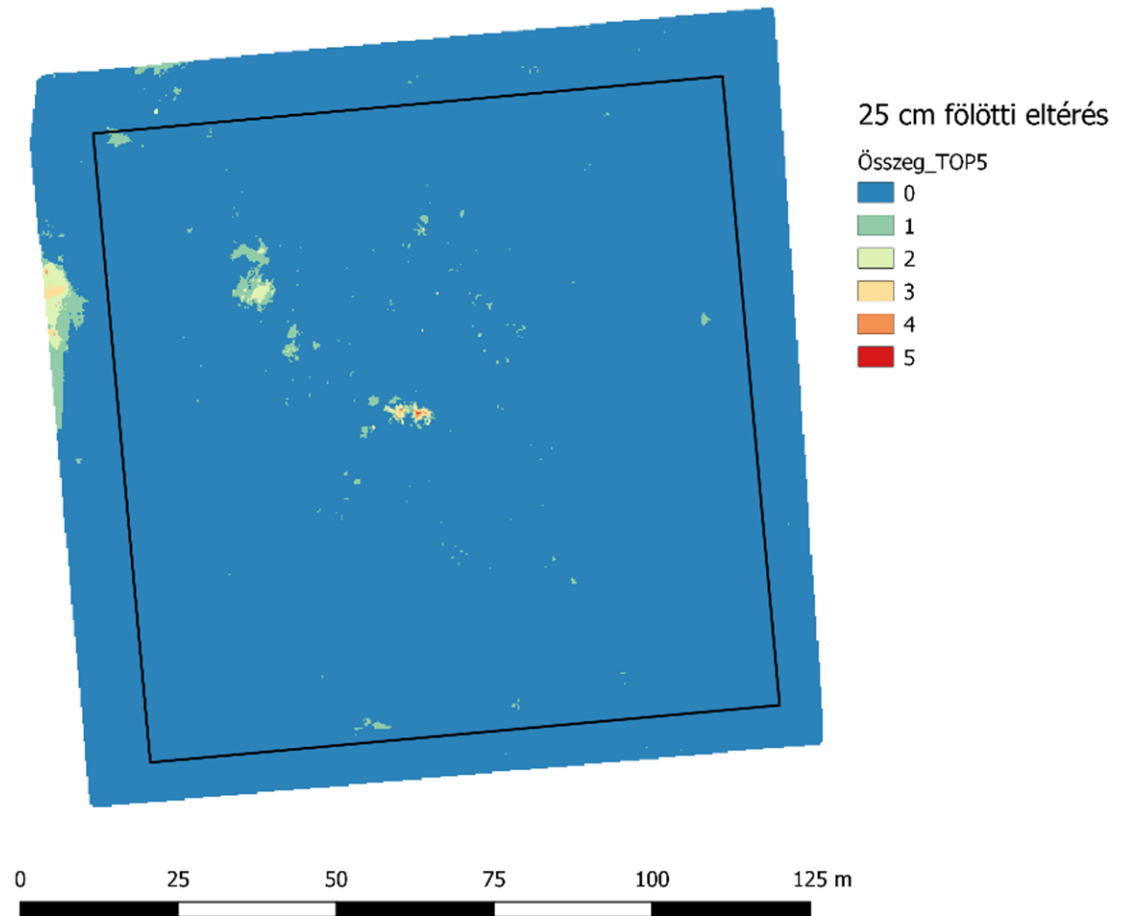
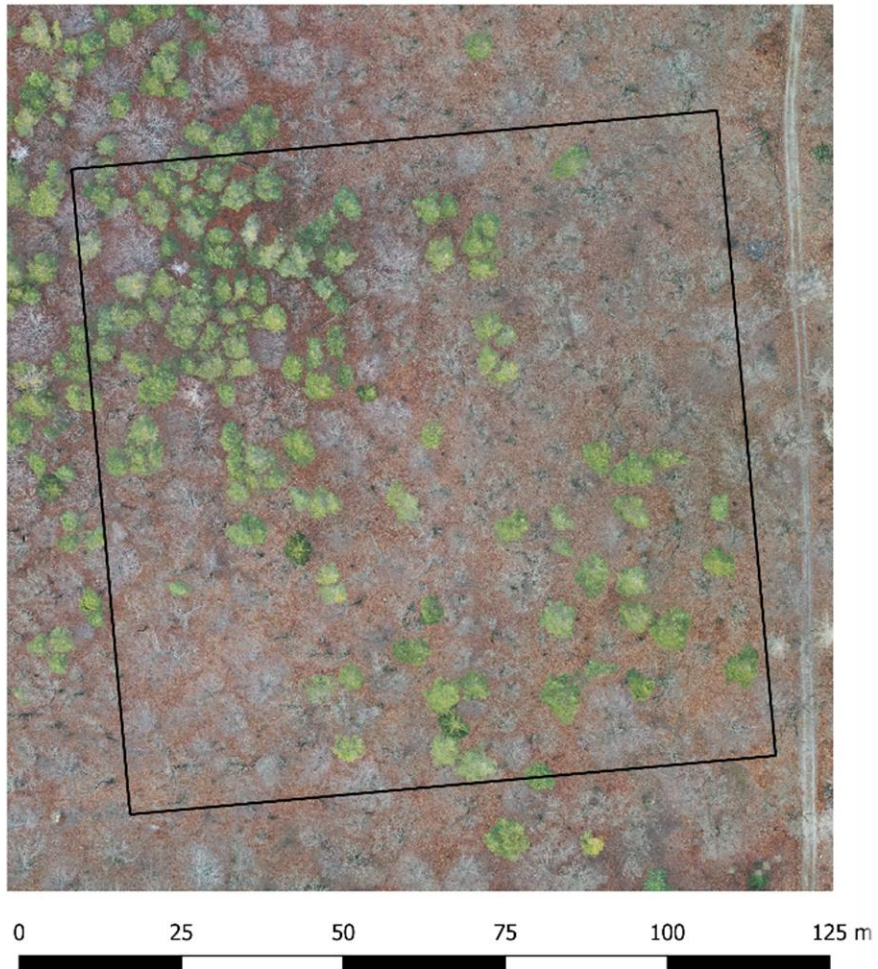
Results

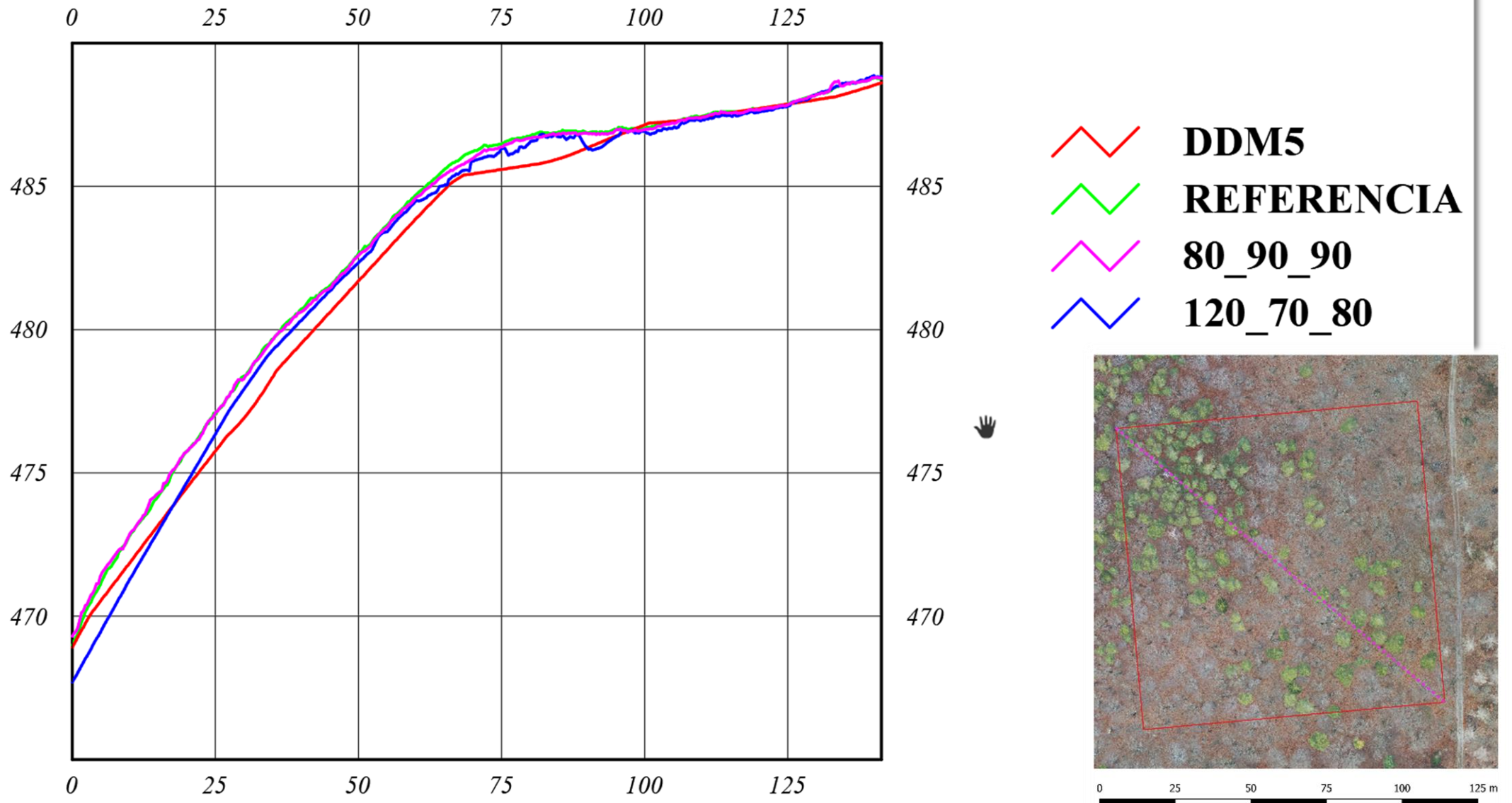
- Unsuccessful Align: 7 cases
- Ranking:
 - Average size of the triangles (m²)
 - Average deviations from ref (m)
 - 99% of the deviations (m)
- Ranking:
 - I. 80_90_90
 - II. 100_90_90
 - III. 80_80_90
 - IV. 100_80_90
 - V. 120_90_90

Eltérésátlag a repülési idő függvényében



Results





Further possibilities

- Multi- hyperspectral camera for better tree species and tree healthy identifications
- ALS/LiDAR sensor for reference measurements
- Better regulations

**Thank You for
Your attention!**

kiraly.geza@emk.nyme.hu

